

IN THE CLAIMS

Please amend the claims as follows:

1 (Withdrawn): A specification-determining method with which to determine a specification of a projection optical system used in an optical apparatus, said determining method comprising:

obtaining target information which said optical apparatus is to achieve; and

determining, based on said target information, the specification of said projection optical system with using one of a wave-front aberration amount and value corresponding to a wave-front aberration, which said projection optical system is to satisfy, as a standard.

2 (Withdrawn): A specification-determining method according to claim 1, wherein, in the determining of said specification, the specification of said projection optical system is determined with using as a standard the coefficient of a specific term selected, based on said target information, from coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded.

3. (Withdrawn): A specification-determining method according to claim 1, wherein, in the determining of said specification, the specification of said projection optical system is determined with using as a standard the RMS value of coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded such that said RMS value within the entire field of said projection optical system is not over a given limit.

4 (Withdrawn): A specification-determining method according to claim 1, wherein, in the determining of said specification, the specification of said projection optical system is determined with using as standards the coefficients of terms of a Zernike polynomial in

which a wave-front in said projection optical system is expanded such that said coefficients are not over given respective limits.

5 (Withdrawn): A specification-determining method according to claim 1, wherein, in the determining of said specification, the specification of said projection optical system is determined with using as a standard the RMS value, within the field of said projection optical system, of coefficients of n 'th order, $m\theta$ terms corresponding to a watched, specific aberration out of coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded such that said RMS value is not over a given limit.

6 (Withdrawn): A specification-determining method according to claim 1, wherein, in the determining of said specification, the specification of said projection optical system is determined with using as a standard the RMS value, within the field of said projection optical system, of coefficients of each group of $m\theta$ terms having the same $m\theta$ value out of terms, which correspond to a watched, specific aberration, out of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded such that said RMS value is not over a given respective limit.

7 (Withdrawn): A specification-determining method according to claim 1, wherein, in the determining of said specification, the specification of said projection optical system is determined with using as a standard the RMS value of coefficients given by weighting according to said target information the coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded such that said RMS value of the weighted coefficients is not over a given limit.

8 (Withdrawn): A specification-determining method according to claim 1, wherein said target information includes information of a pattern subject to projection by said projection optical system.

9 (Withdrawn): A specification-determining method according to claim 1, wherein said optical apparatus is an exposure apparatus which transfers a given pattern onto a substrate via said projection optical system.

10 (Withdrawn): A specification-determining method according to claim 1, wherein in the determining of said specification, based on information of a pattern subject to projection by said projection optical system, a simulation is performed that obtains a space image formed on the image plane when said projection optical system projects with said pattern, and wherein said simulation result is analyzed to determine a limit for wave-front aberration as a standard such that said pattern is transferred finely.

11 (Withdrawn): A specification-determining method according to claim 10, wherein said simulation obtains said space image based on linear combinations between sensitivities of coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded, to a specific aberration for said pattern as a pattern subject to projection and the coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded, said sensitivities depending on said pattern.

12 (Withdrawn): A projection-optical-system making method with which to make a projection optical system used in an optical apparatus, said method comprising:

determining the specification of said projection optical system according to the specification-determining method of claim 1; and

adjusting said projection optical system to satisfy said specification.

13 (Withdrawn): A projection-optical-system making method according to claim 12, wherein, in the determining of said specification, the specification of said projection optical system is determined with using as a standard the coefficient of a specific term selected, based on said target information, from coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded.

14 (Withdrawn): A projection-optical-system making method according to claim 12, wherein, in the determining of said specification, the specification of said projection optical system is determined with using as a standard the RMS value of coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded such that said RMS value within the entire field of said projection optical system is not over a given limit.

15 (Withdrawn): A projection-optical-system making method according to claim 12, wherein, in the determining of said specification, the specification of said projection optical system is determined with using as standards the coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded such that said coefficients are not over given respective limits.

16 (Withdrawn): A projection-optical-system making method according to claim 12, wherein, in the determining of said specification, the specification of said projection optical

system is determined with using as a standard the RMS value, within the field of said projection optical system, of coefficients of n 'th order, $m\theta$ terms corresponding to a watched, specific aberration out of coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded such that said RMS value is not over a given limit.

17 (Withdrawn): A projection-optical-system making method according to claim 12, wherein, in the determining of said specification, the specification of said projection optical system is determined with using as a standard the RMS value, within the field of said projection optical system, of coefficients of each group of $m\theta$ terms having the same $m\theta$ value out of terms, which correspond to a watched, specific aberration, out of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded such that said RMS value is not over a given respective limit.

18 (Withdrawn): A projection-optical-system making method according to claim 12, wherein, in the determining of said specification, the specification of said projection optical system is determined with using as a standard the RMS value of coefficients given by weighting according to said target information the coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded such that said RMS value of the weighted coefficients is not over a given limit.

19 (Withdrawn): A projection-optical-system making method according to claim 12, wherein in the determining of said specification a simulation is performed that obtains a space image formed on the image plane when said projection optical system projects with a pattern subject to projection by said projection optical system, and wherein said simulation

result is analyzed to determine a limit for wave-front aberration as a standard such that said pattern is transferred finely.

20 (Withdrawn): A projection-optical-system making method according to claim 19, wherein said simulation obtains said space image based on linear combinations between sensitivities of coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded, to a specific aberration for said pattern as a pattern subject to projection and the coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded, said sensitivities depending on said pattern.

21 (Withdrawn): A projection-optical-system making method according to claim 12, wherein said target information includes information of a pattern subject to projection by said projection optical system.

22 (Withdrawn): A projection-optical-system making method according to claim 12, wherein in adjusting said projection optical system, said projection optical system is adjusted based on a result of measuring a wave-front aberration in said projection optical system so as to satisfy said specification.

23 (Withdrawn): A projection-optical-system making method according to claim 22, wherein said measuring of a wave-front aberration is performed before installing said projection optical system in the main body of said optical apparatus.

24 (Withdrawn): A projection-optical-system making method according to claim 22, wherein said measuring of a wave-front aberration is performed after having installed said projection optical system in the main body of said optical apparatus.

25 (Withdrawn): A projection-optical-system making method according to claim 12, wherein said optical apparatus is an exposure apparatus which transfers a given pattern onto a substrate via said projection optical system.

26 (Withdrawn): An exposure apparatus which transfers a pattern formed on a mask onto a substrate via an exposure optical system, said exposure apparatus comprising:

a projection optical system made according to the making method of claim 12 as said exposure optical system.

27 (Withdrawn): A device manufacturing method including a lithography process, wherein in said lithography process, an exposure apparatus according to claim 26 performs exposure.

28 (Withdrawn): A method with which to make an exposure apparatus, said method comprising:

making a projection optical system by using the projection-optical-system making method of claim 12; and

installing said projection optical system in the exposure apparatus main body.

29 (Withdrawn): A projection-optical-system making method with which to make a projection optical system used in an exposure apparatus, said method comprising:

adjusting said projection optical system according to exposure conditions scheduled to be used such that a best focus position in at least one point of an exposure area within the field of said projection optical system is displaced by a given amount, said exposure area being illuminated with exposure illumination light.

30 (Withdrawn): A projection-optical-system making method according to claim 29, wherein said exposure conditions include an illumination condition that a coherence factor is smaller than 0.5.

31 (Withdrawn): A projection-optical-system making method according to claim 29, wherein said exposure conditions include use of phase-shift-type masks.

32 (Withdrawn): An exposure apparatus which transfers a pattern formed on a mask onto a substrate via an exposure optical system, said exposure apparatus comprising:

a projection optical system made according to the making method of claim 29 as said exposure optical system.

33 (Withdrawn): A device manufacturing method including a lithography process, wherein in said lithography process, an exposure apparatus according to claim 32 performs exposure.

34 (Withdrawn): A method with which to make an exposure apparatus, said method comprising:

making a projection optical system by using the projection-optical-system making method of claim 29; and

installing said projection optical system in the exposure apparatus main body.

35 (Currently Amended): A projection-optical-system adjusting method with which to adjust a projection optical system used in an ~~optical apparatus~~ exposure apparatus, said adjusting method comprising:

~~measuring a wave-front in said projection optical system~~ obtaining information on a wave-front aberration of a projection optical system whose specification is determined with using one of a wave-front aberration amount and a value corresponding to a wave-front aberration as a standard; and

adjusting said projection optical system based on said obtained information on a wave-front aberration and Zernike Sensitivity corresponding to exposure conditions for an object ~~a result of said measuring of a wave-front~~.

36 (Original): A projection-optical-system adjusting method according to claim 35, wherein, in said adjusting, said projection optical system is adjusted such that the coefficient of a specific term selected, based on target information, from coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded is not over a given limit.

37 (Original): A projection-optical-system adjusting method according to claim 35, wherein, in said adjusting, said projection optical system is adjusted such that the RMS value of coefficients of terms of a Zernike polynomial in which said wave-front within the entire field of said projection optical system is expanded is not over a given limit.

38 (Original): A projection-optical-system adjusting method according to claim 35, wherein, in said adjusting, said projection optical system is adjusted such that the coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded are not over given respective limits.

39 (Original): A projection-optical-system adjusting method according to claim 35, wherein, in said adjusting, said projection optical system is adjusted such that the RMS value, within the field of said projection optical system, of coefficients of n 'th order, $m\theta$ terms corresponding to a watched, specific aberration out of coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded is not over a given limit.

40 (Original): A projection-optical-system adjusting method according to claim 35, wherein, in said adjusting, said projection optical system is adjusted such that the RMS value, within the field of said projection optical system, of coefficients of each group of $m\theta$ terms having the same $m\theta$ value out of terms, which correspond to a watched, specific aberration, out of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded is not over a given respective limit.

41 (Original): A projection-optical-system adjusting method according to claim 35, further comprising:

obtaining information of a pattern subject to projection in said projection optical system,

wherein, in said adjusting, said projection optical system is adjusted based on a space image of said pattern calculated based on linear combinations between sensitivities, to

a watched aberration, of coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded and the coefficients of terms of a Zernike polynomial in which a wave-front measured in said projection optical system is expanded, such that said watched aberration is not over a limit, said sensitivities depending on said pattern.

42 (Currently Amended): A projection-optical-system adjusting method according to claim 35, further comprising:

obtaining target information that said ~~optical~~ exposure apparatus is to achieve, wherein, in said adjusting, said projection optical system is adjusted such that the RMS value of coefficients given by weighting according to said target information the coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded is not over a given limit.

43 (Original): A projection-optical-system adjusting method according to claim 42, wherein said target information includes information of a pattern subject to projection by said projection optical system.

44 (Currently Amended): A projection-optical-system adjusting method according to claim 35, wherein in measuring said wave-front, a wave-front in said projection optical system is measured based on a result of printing a given pattern on a [[wafer]] substrate via a pinhole and said projection optical system.

45 (Original): A projection-optical-system adjusting method according to claim 35, wherein in measuring said wave-front, a wave-front in said projection optical system is measured based on a space image formed via a pinhole and said projection optical system.

46 (Withdrawn): A projection-optical-system adjusting method with which to adjust a projection optical system used in an exposure apparatus, said adjusting method comprising:

performing, when setting exposure conditions that a phase-shift mask is used with a coherence factor of smaller than 0.5 as an illumination condition, prior focus correction that displaces a best focus position in at least one point of an exposure area within the field of said projection optical system by a given amount, said exposure area being illuminated with exposure illumination light.

47 (Withdrawn): A projection-optical-system adjusting method according to claim 46, wherein said phase-shift mask is a space-frequency-modulation type of phase-shift mask.

48 (Withdrawn): A projection-optical-system adjusting method according to claim 46, wherein said prior focus correction is implemented by adjusting an aberration in said projection optical system.

49 (Withdrawn): An exposure apparatus which transfers a given pattern onto a substrate via a projection optical system, said exposure apparatus comprising:

a wave-front measuring unit that measures a wave-front in said projection optical system;

an adjusting unit that adjusts a state of an image of said pattern formed by said projection optical system; and

a controller that controls said adjusting unit using a result of said wave-front measuring unit measuring a wave-front.

50 (Withdrawn): An exposure apparatus according to claim 49, wherein said adjusting unit comprises an imaging-characteristic adjusting mechanism that adjusts the imaging-characteristic of said projection optical system.

51 (Withdrawn): An exposure apparatus according to claim 50, wherein said controller controls said imaging-characteristic adjusting mechanism based on a space image of said pattern calculated based on linear combinations between sensitivities, to a watched aberration, of coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded and the coefficients of terms of a Zernike polynomial in which a wave-front measured in said projection optical system is expanded, such that said watched aberration is not over a limit, said sensitivities depending on said pattern.

52 (Withdrawn): A device manufacturing method including a lithography process, wherein in said lithography process, an exposure apparatus according to claim 49 performs exposure.

53 (Withdrawn): A computer system comprising:

a first computer into which target information that an optical apparatus is to achieve is inputted; and

a second computer which is connected to said first computer via a communication path and determines the specification of a projection optical system used in said optical apparatus based on said target information received from said first computer via said

communication path with using one of a wave-front aberration amount and value corresponding to a wave-front aberration, which said projection optical system is to satisfy, as a standard.

54 (Withdrawn): A computer system according to claim 53, wherein said target information includes information of a pattern subject to projection by said projection optical system, and

wherein said second computer performs a simulation that obtains a space image formed on the image plane when said projection optical system projects with said pattern, based on said pattern information, and analyzes said simulation result to determine a limit for wave-front aberration in said projection optical system as a standard such that said pattern is transferred finely.

55 (Withdrawn): A computer system according to claim 54, wherein said second computer obtains said space image based on linear combinations between sensitivities of coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded, to a specific aberration for said pattern as a pattern subject to projection and the coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded, said sensitivities depending on said pattern.

56 (Withdrawn): A computer system according to claim 53, wherein said optical apparatus is an exposure apparatus which transfers a given pattern onto a substrate via said projection optical system.

57 (Withdrawn): A computer system according to claim 53, wherein said communication path is a local area network.

58 (Withdrawn): A computer system according to claim 53, wherein said communication path includes a public telephone line.

59 (Withdrawn): A computer system according to claim 53, wherein said communication path includes a radio line.

60 (Withdrawn): A computer system comprising:
a first computer which is connected to an exposure apparatus main body which transfers a given pattern onto a substrate via a projection optical system; and
a second computer which is connected to said first computer via a communication path, performs a simulation that obtains a space image formed on the image plane when said projection optical system projects with said pattern, based on information of said pattern received from said first computer via said communication path and known aberration information of said projection optical system, and analyzes said simulation result to determine best exposure conditions.

61 (Withdrawn): A computer system according to claim 60, wherein said pattern information is part of exposure conditions that are inputted into said first computer.

62 (Withdrawn): A computer system according to claim 60, further comprising:
a reading-in unit that reads in said pattern information recorded on a mask on a path on which said mask is transported to said exposure apparatus main body,

wherein said pattern information is inputted into said first computer via said reading-in unit.

63 (Withdrawn): A computer system according to claim 60,
wherein said second computer sends said best exposure conditions determined to said first computer via said communication path.

64 (Withdrawn): A computer system according to claim 63,
wherein said first computer sets exposure conditions of said exposure apparatus main body to said best exposure conditions.

65 (Withdrawn): A computer system according to claim 60, wherein said second computer obtains said space image based on linear combinations between sensitivities of coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded, to a specific aberration for said pattern as a pattern subject to projection and the coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded, which wave-front is obtained based on a result, sent by said first computer via said communication path, of measuring a wave-front in said projection optical system, said sensitivities depending on said pattern.

66 (Withdrawn): A computer system according to claim 65, wherein said result of measuring a wave-front is inputted into said first computer.

67 (Withdrawn): A computer system according to claim 65, further comprising:

a wave-front measuring unit that measures a wave-front in said projection optical system,

wherein said first computer itself obtains said result of measuring a wave-front from said wave-front measuring unit.

68 (Withdrawn): A computer system according to claim 60, wherein said best exposure conditions include information of a pattern suitable for exposure by said exposure apparatus main body.

69 (Withdrawn): A computer system according to claim 60, wherein said best exposure conditions include at least one of an illumination condition for transferring a given pattern and numerical aperture of said projection optical system.

70 (Withdrawn): A computer system according to claim 60, wherein said best exposure conditions include specification of aberration due to said projection optical system upon transferring said given pattern.

71 (Withdrawn): A computer system according to claim 70, further comprising:
an imaging-characteristic adjusting mechanism that adjusts the imaging-characteristic of said projection optical system provided in said exposure apparatus main body connected to said second computer via said communication path,

wherein said second computer controls said imaging-characteristic adjusting mechanism, based on said best exposure conditions determined, to adjust the imaging-characteristic of said projection optical system.

72 (Withdrawn): A computer system according to claim 60, wherein said communication path is a local area network.

73 (Withdrawn): A computer system according to claim 60, wherein said communication path includes a public telephone line.

74 (Withdrawn): A computer system according to claim 60, wherein said communication path includes a radio line.

75 (Withdrawn): A computer system comprising:

a first computer which is connected to an exposure apparatus main body having a projection optical system that projects an image of a given pattern onto a substrate;

an adjusting unit which adjusts a state of an image of said pattern formed by said projection optical system; and

a second computer which is connected to said first computer via a communication path,

wherein said second computer calculates control information with which to control said adjusting unit, using a result of measuring a wave-front in said projection optical system, which result has been received from said first computer via said communication path, and

wherein one of said first and second computers controls said adjusting unit based on said control information.

76 (Withdrawn): A computer system according to claim 75, wherein said result of measuring a wave-front is inputted into said first computer.

77 (Withdrawn): A computer system according to claim 75, further comprising:
a wave-front measuring unit that measures a wave-front in said projection optical system,
wherein said first computer itself obtains said result of measuring a wave-front from said wave-front measuring unit.

78 (Withdrawn): A computer system according to claim 75, wherein said adjusting unit comprises an imaging-characteristic adjusting mechanism that adjusts the imaging-characteristic of said projection optical system.

79 (Withdrawn): A computer system according to claim 78, wherein said first computer sends information of said pattern used in said exposure apparatus main body to said second computer via said communication path, and

wherein said second computer obtains a space image formed on the image plane when said projection optical system projects with said pattern by a simulation based on said pattern information and said result of measuring a wave-front, calculates a limit for a watched aberration due to said projection optical system at which said space image is finely formed, and calculates control information with which to control said imaging-characteristic adjusting mechanism such that said watched aberration due to said projection optical system is not over said limit.

80 (Withdrawn): A computer system according to claim 79, wherein said second computer calculates a space image of said pattern based on linear combinations between sensitivities, to a watched aberration, of coefficients of terms of a Zernike polynomial in which a wave-front in said projection optical system is expanded and the coefficients of terms

of a Zernike polynomial in which a wave-front measured in said projection optical system is expanded, said sensitivities depending on said pattern.

81 (Withdrawn): A computer system according to claim 75, wherein a plurality of sets of said exposure apparatus main body and said first computer are provided, and said exposure apparatus main bodies each have said adjusting unit, and

wherein said second computer is connected via said communication path to at least one of the set of said plural first computers and the set of said plural adjusting units.

82 (Withdrawn): A computer system according to claim 75, wherein said communication path is a local area network.

83 (Withdrawn): A computer system according to claim 75, wherein said communication path includes a public telephone line.

84 (Withdrawn): A computer system according to claim 75, wherein said communication path includes a radio line.

85 (New): A projection-optical-system adjusting method according to claim 35, wherein based on said obtained information on a wave-front aberration and said Zernike Sensitivity, adjustment information of said projection optical system is calculated using the least-squares method in order to adjust said projection optical system based on the adjustment information.

86 (New): A projection-optical-system adjusting method according to claim 85, wherein based on data regarding a relation between an adjustment amount of an optical element of said projection optical system and variation of coefficients of terms of a Zernike polynomial, the adjustment amount of the optical element of said projection optical system is calculated as said adjustment information.

87 (New): A projection-optical-system adjusting method according to claim 86, wherein coefficients of terms of a Zernike polynomial are determined by measuring a wave-front aberration of said projection optical system, and in calculation of said adjustment amount said determined coefficients of terms of a Zenike polynomial are used.

88 (New): A projection-optical-system adjusting method according to claim 87, wherein an adjustment amount of said optical element is calculated such that an error of an image of a pattern is not over a given limit at each of a plurality of points in a predetermined area where the pattern is projected, within a field of said projection optical system.

89 (New): A projection-optical-system adjusting method according to claim 88, wherein said exposure conditions includes at least an illumination condition for a pattern to be transferred on said object.

90 (New): A projection-optical-system adjusting method according to claim 35, wherein
said adjustment of said projection optical system is performed before said projection optical system is installed in said exposure apparatus, and

in said adjustment before the installation, at least one of reprocessing, replacement and position adjustment of an optical element of said projection optical system is performed.

91 (New): A projection-optical-system adjusting method according to claim 35, wherein

measurement of information on said wave-front aberration and said adjustment of said projection optical system are performed after said projection optical system is installed in said exposure apparatus, and

in said adjustment after the installation, position adjustment of an optical element of said projection optical system is performed.

92 (New): A projection-optical-system adjusting method according to claim 91, wherein

said adjustment of said projection optical system is performed before said projection optical system is installed in said exposure apparatus, and

in said adjustment before the installation, at least one of reprocessing, replacement and position adjustment of an optical element of said projection optical system is performed.

93 (New): An exposure method with which to transfer a pattern onto an object via a projection optical system, said method comprising:

adjusting said projection optical system using the projection-optical-system adjusting method according to claim 91; and

forming an image of said pattern on said object via said adjusted projection optical system.

94 (New): An exposure method according to claim 93, wherein based on said obtained information on a wave-front aberration and said Zernike Sensitivity, adjustment information of said projection optical system is calculated using the least-squares method in order to adjust said projection optical system based on the adjustment information.

95 (New): An exposure method according to claim 94, wherein based on data regarding a relation between an adjustment amount of an optical element of said projection optical system and variation of coefficients of terms of a Zernike polynomial, the adjustment amount of the optical element of said projection optical system is calculated as said adjustment information.

96 (New): An exposure apparatus that transfers a pattern onto an object, said exposure apparatus comprising:

a projection optical system which has a plurality of optical elements to form an image of said pattern on said object, and a specification of which is determined with using one of a wave-front aberration amount and a value corresponding to a wave-front aberration, as a standard; and

an adjusting unit which includes an actuator provided in said projection optical system, and adjusts said projection optical system based on information on a wave-front aberration of said projection optical system and Zernike Sensitivity corresponding to exposure conditions for said object.

97 (New) An exposure apparatus according to claim 96, wherein said adjusting unit calculates adjustment information of said projection optical system using the least-squares

method, based on said information on a wave-front aberration and said Zernike Sensitivity, and controls said actuator based on the adjustment information.

98 (New): An exposure apparatus according to claim 97, wherein said adjusting unit calculates an adjustment amount of an optical element of said projection optical system as said adjustment information, based on data regarding a relation between the adjustment amount of the optical element of said projection optical system and variation of coefficients of terms of a Zernike polynomial.

99 (New): An exposure apparatus according to claim 98, further comprising:
a measuring unit at least a part of which is disposed on a side of an image plane with respect to said projection optical system in order to measure a wave-front aberration of said projection optical system; and wherein

said adjusting unit determines coefficients of terms of a Zernike polynomial from said measured wave-front aberration, and

in calculation of said adjustment amount, said determined coefficients of terms of a Zernike polynomial are used.

100 (New): An exposure apparatus according to claim 99, wherein an adjustment amount of said optical element is calculated such that an error of an image of a pattern is not over a given limit at each of a plurality of points in a predetermined area where the pattern is projected, within a field of said projection optical system.

101 (New): An exposure apparatus according to claim 100, wherein said exposure conditions includes at least an illumination condition for a pattern to be transferred onto said object.

102 (New): An exposure apparatus according to claim 96, wherein
a wave-front aberration of said projection optical system is measured before said
projection optical system is installed in said exposure apparatus, and
based on the measured wave-front aberration, at least one of reprocessing,
replacement and position adjustment of an optical element of said projection optical system is
performed.